

Optical Coating Degradation Due to Particle Impacts

Completed Technology Project (2014 - 2015)



Project Introduction

Charged particles are an important source of contamination for laser transmitter optics. However, these effects are not currently included in the GSFC contamination model, a deficiency that could result in compromising entire space missions. We will develop an all-purpose model to evaluate and mitigate the risk of laser contamination from charged particles, an accomplishment that will provide GSFC with a competitive advantage in future proposals, in particular for many of the missions in the NASA Earth Science Decadal Survey.

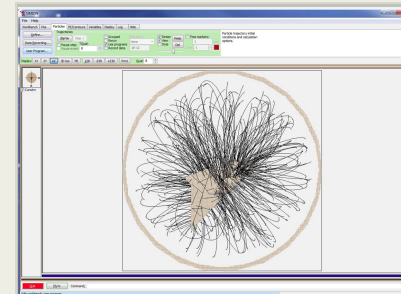
With so many missions relying on well-functioning lasers, the evaluation and mitigation of charged particle contamination to laser optics is clearly of immense importance. Furthermore, Goddard Space Flight Center with its diverse cadre of experts covering all relevant aspects of this problem is perfectly positioned to develop the machinery to evaluate and mitigate this serious threat to mission success.

The motivation for this IRAD proposal is the three year long ICESat-2/ATLAS instrument Optical Coatings Life Test (OCLT) that addressed molecular contamination, but only in the laboratory - not in the space environment. Analysis of the OCLT measurements and telemetric data from previous NASA Lidar missions including ICESat/GLASS and LRO/LOLA have revealed degradation in the optical throughput of the Laser Transmitter (LT) optics (but not the laser itself) and significantly greater laser beam divergence. The combination of these two effects resulted in a significant reduction in LT performance. This level of reduction is significantly greater than the predictions of the NASA molecular contamination model for the LT optics: it predicts only a 1.4% degradation for the ICESat-2/ATLAS LT optics. Furthermore, the OCLT-based LT optics life predictions for laser assisted molecular hydrocarbon contamination may not completely explain the level of LT optics performance degradation experienced by previous NASA Lidar missions. Because the ICESat-2/ATLAS development is currently in the Integration and Testing stage, it is too far along to accommodate this proposed research within the ATLAS Instrument budget and schedule or to modify the ATLAS LT design based on the results of the proposed modeling tool.

This IRAD will develop a completely new modeling capability for use as a design tool for any future NASA mission that includes a Lidar. This capability has the potential to significantly extend the operational life of LT optics (assuming the other instrument subsystems continue to function nominally) by reducing contamination-related risk. This will result in both cost savings and improved data quality.

Anticipated Benefits

Future missions



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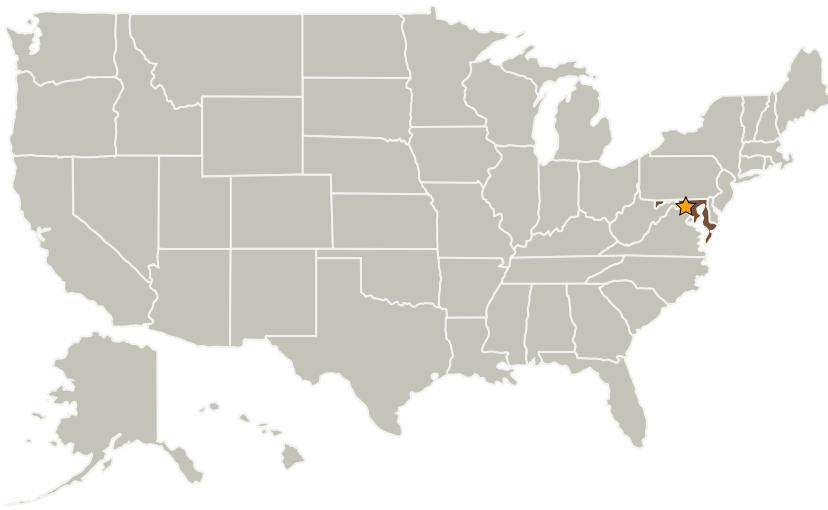


This NASA technology has potential to be transferred to the commercial space industry.

Benefits will be equivalent to those that NASA will have.

NOAA, FDA, DoD, DHS.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Goddard Space Flight Center (GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations

Maryland

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Manager:

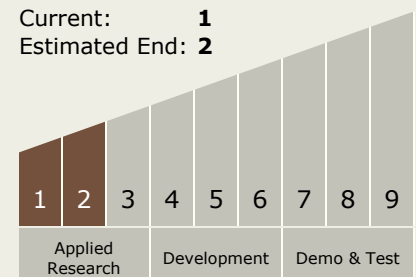
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Principal Investigator:

Branimir Blagojevic

Technology Maturity (TRL)

Start: **1**
Current: **1**
Estimated End: **2**

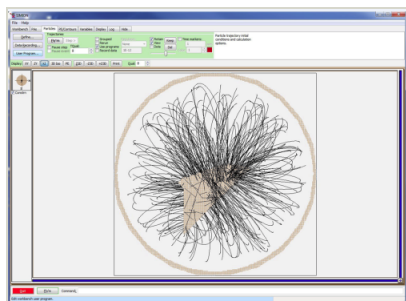


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Images



Optical Coating Degradation Due to Particle Impacts Project

Optical Coating Degradation Due to Particle Impacts Project
(<https://techport.nasa.gov/image/19346>)

Links

NTR 1438101668
(no url provided)

Project Website:

<http://aetd.gsfc.nasa.gov>

Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
 - └ TX11.5 Mission Architecture, Systems Analysis and Concept Development
 - └ TX11.5.2 Tools and Methodologies for Performing Systems Analysis